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(54) IMPROVEMENTS IN OR RELATING TO INSULATED ELECTRIC CONDUCTORS

(71) We, BRITISH INSULATED CALLENDER'S CABLES LIMITED, a British Company, of 21 Bloomsbury Street, London, W.C.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to insulated electric conductors and to multi-conductor electric cables comprising a plurality of insulated conductors and to the manufacture thereof. More particularly the invention is concerned with the provision of a conductor insulation covering, generally but not necessarily of a rubber or plastics material having over its surface a coloured identification coding or marking.

In order to identify the insulated conductors of a multi-conductor cable comprising a plurality of insulated conductors, for instance an electric communication cable, it is the general practice to provide over the surface of the insulation of each conductor a coloured identification coding or marking that is distinguishable from the codings or markings on the other insulated conductors. Such codings or markings normally take the form of helical or longitudinal stripes or longitudinally spaced circumferential bands of one or more contrasting colours and these are generally, but not necessarily, formed by applying a small stream or streams of marking fluid to the surface of the conductor insulation from one or more suitable applicators as the conductor is caused to travel in the direction of its length.

It is an object of the present invention to provide an insulated electric conductor having an improved coloured identification coding or marking over the surface of the conductor insulation which is readily identifiable and which is also of such a form as to enable an insulated conductor to be marked as it advances in the direction of its length at a linear speed of travel substantially greater than that at which it has hitherto been possible to advance a conductor during marking to provide coloured identification coding or marking of known forms.

According to the invention our improved insulated electric conductor has randomly distributed over the surface of the conductor insulation mutually spaced coding or marking areas (hereinafter referred to as "blobs") of a colour or colours distinguishable from that of the surface of the conductor insulaton.

By reference to the blobs being "mutually spaced" is meant that each blob is spaced from any other blob over at least a part or parts of its circumference so that the basic colour of the insulation surface remains visible; local overlap between neighbbouring blobs is not excluded.

The blobs may be of substantially the same shape and/or size but preferably they can and do vary in shape in size provided that the basic colour of the conductor insulation and the colour or colours of the blobs can be clearly seen and readily identified. For example, the blobs may be in the form of spots or they may be in the form of streaks.

The invention also includes a multi-conductor electric cable comprising a plurality of insulated conductors each having mutually spaced coloured blobs randomly distributed over the surface of the conductor insulation, the blobs of each insulated conductor being of a colour distinguishable from that of the surface of the conductor insulation, and at least some of the insulated conductors having a combination of surface colour and blob colour distinguishable from that of other insulated conductors.

The surfaces of the conductor insulations of the conductors may all be of the same basic colour or they may be of different colours. However, the use of conductors which differ only in that the colour of the insulation surface and of the blobs are inter-

changed is best avoided. Where the cable comprises a multiplicity of insulated conductors some or all of the conductors may carry blobs of two or more different colours both or all of which are distinguishable from that of the surface of the insulation of that conductor and at least one of which is distinguishable from that of any of the blobs on any other conductor having the same coloured insulation surface; in this case, opaque colours are preferably used to avoid the uncontrolled production of an additional colour where the blobs chance to overlap.

A multi-conductor cable in accordance with the present invention may also include one or more insulated conductors having a coloured identification coding or marking of a known form or known forms.

It will be appreciated that the form of colouored identification coding or marking of the present invention has the important advantage that it is unnecessary closely to control the size, shape and spacing of the blobs so long as the method and apparatus employed in applying the blobs of marking fluid over the conductor insulation enables the contrasting colours of the surface of the conductor insulation and of the blobs of each insulated conductor to be clearly seen and readily distinguished from those of other conductors.

The invention further includes a method of forming on the surface of an insulated conductor randomly distributed mutually spaced blobs of a colour or colours distinguishable from that of the surface of the conductor insulation which method comprises causing the insulated conductor to travel past or through one or more than one applicator device which spatters or otherwise randomly applies discrete droplets of marking fluid on the advancing insulated conductor. Where the blobs are to be of two or more contrasting colours, two or more applicator devices may be employed, each applying discrete droplets of a marking fluid of a different colour. Such applications should preferably be spaced in the direction of travel of the conductor sufficiently to allow the fluid of each colour to dry before another colour is applied, in order to avoid mixing of the colours.

Preferably the conductor is caused to travel axially through or between an applicator device or devices which direct discrete droplets of marking fluid onto the surface of the advancing insulated conductor from at least two directions so as to apply blobs to the whole circumference thereof but the insulated conductor may be caused to travel past an applicator device located to one side of the conductor which spatters discrete droplets towards the conductor and in this case preferably means is provided for deflecting droplets that pass on one or both sides of the conductor back on to the surface of the conductor insulation remote from the applicator device. Alternatively where a single applicator device is used, provision may be made for effecting relative rotation between the conductor and the applicator; preferably the applicator, located to the one side of the advancing conductor, is arranged to rotate about the conductor.

In order to ensure that a substantial proportion of the discrete droplets of marking fluid emitted from an applicator are deposited on the surface of the conductor insulation an electrostatic difference of potential may be produced between the conductor and the discrete droplets of marking fluid, for instance by electrostatically charging the droplets with a high voltage, whereby a substantial proportion of the droplets are caused to adhere to the surface of the conductor insulation. By this latter process droplets can also be directed to adhere to the side of the insulated conductor that is remote from the applicator device.

It will be appreciated that since the colour identification coding or marking employed in the present invention is only dependent upon the combination of the basic colour of the conductor insulation and the colour or colours of the blobs, the invention has the important advantage that the relative size, shape and spacing of the blobs need not be closely controlled with the result that discrete droplets of marking fluid can be satisfactorily spattered or otherwise applied on to an advancing conductor whilst the conductor is travelling at speeds of 6000 ft/min. and upwards.

In the accompanying drawings:

Figure 1 shows by way of example one form of marked conductor in accordance with the invention;

Figure 2 is a sketch of one form of apparatus for use in making conductors in accordance with the invention; and

Figure 3 is a diagrammatic cross-section of a nozzle.

As seen in Figure 1, the conductor 1 has applied to it coloured blobs 2 which are randomly distributed and also vary in shape and size. The spacing of the blobs is such that the colour of the insulation surface remains clearly visible. The blobs 2 are preferably all of the same colour if only a small number of conductors need to be distinguished; otherwise two or more colours may be used.

In the apparatus shown in Figure 2, the conductor 1 is advanced at a high speed in the direction of its length past two applicator nozzles 4 directed on opposite sides of the conductor and supplied with ink or other liquid colouring material by a pump 5. Excess colouring material is intercepted by a collector 6 and returned to the reservoir

7. The form of the nozzles is not critical since practically any nozzle can be made to produce a spray of widely spaced droplets by adjustment of the feed pressure. However, an adjustable nozzle of the type shown in Figure 3 (which is commonly used on garden hoses) has been found particularly convenient. In this type of nozzle the fluid flows through passages 8 in an inner nozzle member 9 and thence to an annular chamber 10 formed between the inner nozzle member and an outer nozzle member 11. The fluid is discharged through an annular gap 12 between the outer member 11 and a shaped extension 13 on the inner member 9, and the inner and outer members are in screw-threaded engagement to permit adjustment of this gap. The retaining cap 14 prevents accidental complete removal of the outer member 11.

WHAT WE CLAIM IS:—

1. An insulated electric conductor having randomly distributed over the surface of the conductor insulation mutually spaced blobs of a colour or colours distinguishable from that of the surface of the conductor insulation.

2. A conductor as claimed in Claim 1 in which the blobs take the form of spots and/or streaks.

3. A multiconductor electric cable comprising a plurality of insulated conductors each having mutually spaced coloured blobs randomly distributed over the surface of the conductor insulation, the blobs of each insulated conductor being of a colour distinguishable from that of the surface of the conductor insulation and at least some of the insulated conductors having a combination of surface colour and blob colour distinguishable from that of other insulated conductors.

4. A cable as claimed in Claim 3 in which at least one conductor carries blobs of two or more different colours both or all of which are distinguishable from that of the surface of that conductor and at least one of which is distinguishable from that of any of the blobs on any other conductor that has the same coloured insulation surface.

5. A method of forming on the surface of an insulated conductor randomly distributed mutually spaced blobs of a colour distinguishable from that of the surface of the conductor insulation comprising causing the insulated conductor to travel past or through one or more than one applicator device which spatters or otherwise randomly applies discrete droplets of marking fluid onto the advancing insulated conductor.

6. A method as claimed in Claim 5 in which the droplets are applied by spraying.

7. A method as claimed in Claim 5 or Claim 6 in which are employed two or more applicator devices, spaced in the direction of travel of the conductor, each applying discrete droplets of marking fluid of a different colour.

8. A method as claimed in any one of Claims 5 to 7 in which the conductor is passed through or between an applicator device or devices for the or each colour of marking fluid which direct discrete droplets of marking fluid onto the surface of the conductor from at least two directions so as to apply blobs to the whole circumference thereof.

9. A method as claimed in Claim 5 or Claim 6 in which the or each applicator is located to one side of the conductor and in which droplets which pass on one or both sides of the conductor are deflected back onto the surface of the conductor insulation remote from the applicator device.

10. A method as claimed in any one of Claims 5 to 7 in which the or each colour of marking fluid is applied to the conductor by a single applicator device and in which relative rotation between the conductor and the applicator takes place.

11. A method as claimed in any one of Claims 5 to 10 comprising producing an electrostatic difference of potential between the conductor and the discrete droplets of marking fluid.

12. An insulated electric conductor substantially as hereinbefore described by way of example with reference to Figure 1 of the accompanying drawings.

13. An electric cable substantially as hereinbefore described.

14. A method of marking an insulated conductor, substantially as hereinbefore described.

15. A method of marking an insulated conductor, substantially as hereinbefore described with reference to the accompanying drawings.

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

Fig.1.

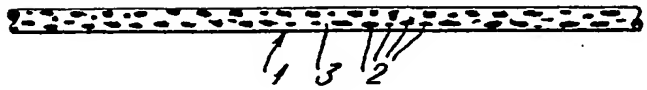

Fig.2.

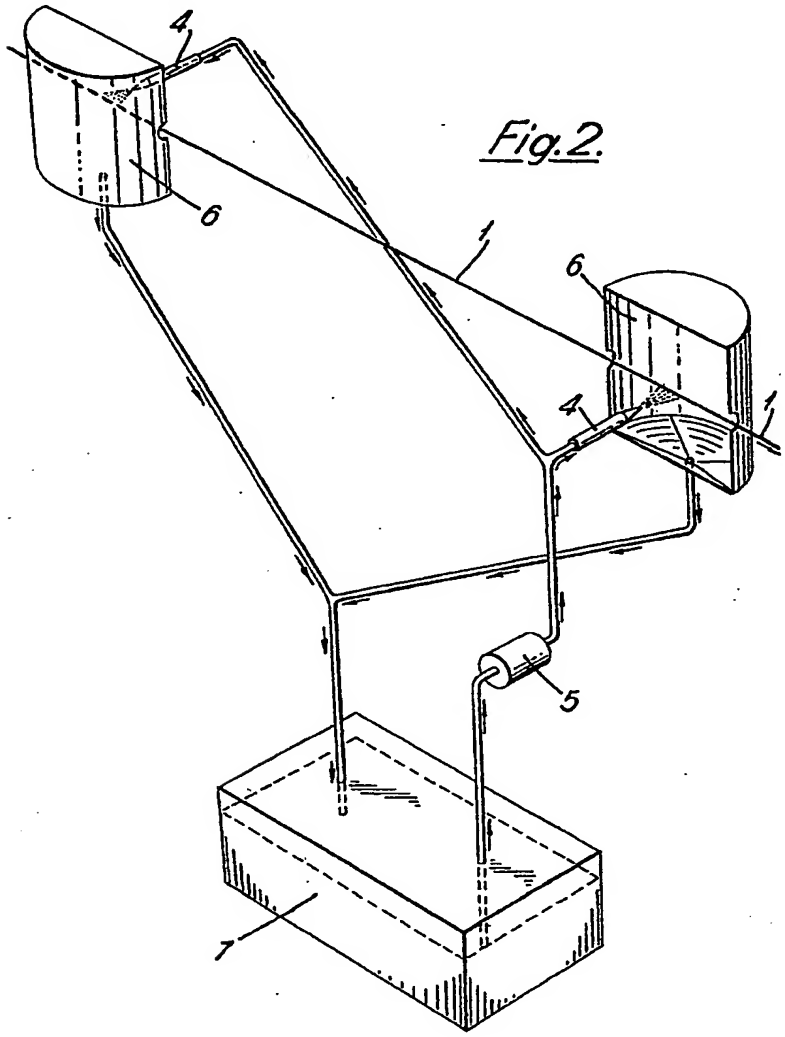

Fig. 3.